Optimization

Nonlinear Optimization

✓ • Gradient method

Describe the gradient method for unconstrained opt. problems, and provide an illustrative example. Discuss the convergence properties of the method, its advantages and disadvantages. Briefly describe one type of approach that has been proposed to circumvent the above-mentioned disadvantages.

• Newton method (& Quasi-Newton methods)

Describe the Newton method for unconstrained nonlinear opt. problems. Discuss the properties of the method, state the main results and indicate the advantages and disadvantages. Describe the general idea of quasi-Newton methods and that of the Davidon-Fletcher-Powell (DFP) method, emphasizing the advantages with respect to the Newton method.

✓ • Conjugate direction method(*)

✓ • Quadratic programming(*)

Describe the method presented in the course for solving the so-called quadratic programming problems, that is, the constrained nonlinear optimization problems with a quadratic objective function subject to linear inequality and equality constraints. Discuss the properties of the method (start with only equalities and then with inequalities too), and indicate the advantages and disadvantages.

✓ • Penalty methods

Describe the quadratic penalty method for constrained nonlinear optimization problems, and provide an illustrative example. State and discuss the main properties of this method and the limitations when the penalty terms are simply added to the objective function. Briefly descrive the approach thtat has been proposed to circumvent such limitations.

✓ • Barrier methods

• Problem

    – *establish if it is a convex optimization problem*
    – *determine graphically the global minimum (optimal solution) and the global maximum*
    – *draw the feasible region*
    – *establish if the constraint qualification assumption is satisfied at all points of the feasible region*
    – *state the first order optimality conditions*
    – *determine all the points satisfying the Karush-Kuhn-Tucker conditions*
    – *indicate and explain why these conditions are necessary and/or sufficient*
    – *write the Lagrangian dual problem*
    – *state the main properties of the dual and describe how it can be solved*
    – *indicate the connection between the primal problem and the dual problem under consideration*